

## Why net neutrality is important

I wrote a research paper on the topic of Network Neutrality in my Senior Computer Science Seminar class. After researching the topic I believe that network neutrality is very important to a free and open internet and maintaining the values of america that are implied in the constitution. Without Net Neutrality legislation service providers can and will try to control what people can see and do on the internet. This completely goes against everything the internet was built to be. I hope that some of the points I make might change your mind, all sources are cited.

### Network Neutrality: Why you should care

Since the earliest days of the internet all traffic traveling along it was treated with equal importance. This concept of treating all traffic equally is known as Network Neutrality. Though precise definitions of the term vary it was popularized in academic circles in 2003 by Tim Wu. Wu defines networks neutrality as,

"Network neutrality is best defined as a network design principle. The idea is that a maximally useful public information network aspires to treat all content, sites, and platforms equally. This allows the network to carry every form of information and support every kind of application. The principle suggests that information networks are often more valuable when they are less specialized – when they are a platform for multiple uses, present and future." (Wu)

Wu, along with most other computer scientists who have voiced their opinion on the topic, argue that maintaining Network Neutrality is in the best interest of the internet (Wu 146).

The concept of Network Neutrality was not originally devised because of the internet, but is based is instead based on centuries old telecommunications law (Cerf 4). The term has only recently been coined, but the concept was first introduced as legislation in 1860 to control communication by telegraph between the east and west coast.

"...messages received from any individual, company, or corporation, or from any telegraph lines connecting with this line at either of its termini, shall be impartially transmitted in the order of their reception." (Act)

The legislation was arguably written to help keep the cost of communication affordable and free from corruption. By not being able to prioritize messages the companies were forced to charge a standard rate making communication more affordable for all.

The concept was also applied to the internet when it was created and it is what Wu argues should be defended by legislation of network neutrality laws and is implied by the end-to-end principal that is build into the internet (146).

"The End-to-End argument says don't force any service, feature, or restriction on the customer; his application knows best what features it needs, and whether or not to provide those features itself." (Wu 146).

The End-to-End principal first arose in 1984 in a paper by Saltzer, Reed, and Clark. The principal says that all communication protocol operations such as building and analyzing packets should be

handled by the endpoints (Saltzer 3). The endpoints of communication in regards to the internet would be the user's computer or server. The concept argues that no communication protocol operation should be preformed on data while information is being transmitted for optimal network operation (Saltzer 3). Any attempt to setup a non-neutral network would be in defiance of the end-to-end principal because it would involve communication protocol operations while the information is in transmission across the network (Wu 146). Data would have to be scanned and identified by routers and switches across the network. In theory this would have a negative affect on transmission time and would slow down internet communication (Felten 9).

In 2003 Tim Wu published an article warning that the technology was available to make the network non-neutral and that legislation should be passed in order to maintain network neutrality on the internet before it was too late (Wu 172). Today the companies that provide broadband internet to consumers, or last-mile carriers, are trying to use their corner on the market to discriminate against certain traffic (Wu 152). This would put them in a position to control what sort of content the average internet user could access (Wu 152). This however goes against the guiding principals that the internet was founded upon. The architecture of the internet was originally setup so that control was kept on the "edges" of the network and all internal routing of traffic would be dumb in nature (Cerf 3). By following these principals the internet could be kept free from outside influences. The problem was that when the internet was created all sides wanted the government to take a deregulatory approach (Cerf 4). The idea was that by taking such a stance the internet would be able to grow on its own and allow for vibrant user activity and creativity to occur at the network edges (Cerf 3).

In 1996 the FCC passed regulations to make sure that phone companies were not the only companies who could provide internet access (Cerf 4). The regulations said that the local phone companies who controlled most of the backbones had to allow other companies access to their backbone at reasonable prices to allow for competition in internet access (Cerf 4). The reasoning behind the law was that the government had allowed these telephone companies to build their networks in municipalities around the country with no threat of interference or competition (Cerf 6). This worked wonders when most consumers used dialup internet access from a plethora of different service providers. Because of the competition no companies tried to impose any kind of discrimination against the data flowing across their network for fear that their customer would switch to a competing service (Cerf 6). These regulations however only allow for competition in the form of dialup access and wireless access in some cases (Cerf 5). Telephone and cable companies are the only companies who have a physical broadband connection that actually directly links to most consumers' homes or businesses (Cerf 6). This leaves consumers with very little choice in broadband internet service and little room for any sort of competition due to the lack of high bandwidth connection to the customer. Recent studies show that 53% of American internet users have the choice between only two broadband internet service providers, their telephone company or cable company (Cerf 4). Another 28% only have one choice for broadband internet and the remaining 19% have no broadband internet available to them (Cerf 4). This has left broadband providers in the position of wanting to discriminate against what can flow across their networks and in

addition what sort of treatment it gets in an attempt to increase profits (Cerf 5). What these broadband providers have proposed is that if an internet content provider wants to be able to gain access to its customers via

their networks they must pay some sort of access fee or tax to the broadband provider (Cerf 5). If the content providers such as websites, VoIP services, and application developers didn't pay the fee the broadband providers could do a wide variety of things to packets coming to or from their service to severely degrade the quality of that service for that product. Broadband providers could give packets from services who don't pay them a tax or fee certain flags in their routers to make traffic to or from that website act in a certain way (Felton 3). This is contradictory to the principals that the internet was founded on, which was that all internet traffic should be handled with equal importance by routers (Saltzer 3).

There are several technical methods that could be used to implement such forms of discrimination across a network that can make it difficult to detect if the owner of the network doesn't openly acknowledge the discrimination (Felton 5). Every router on the internet has a buffer that is sometimes used to buffer packets if the outgoing connection is currently in use or has a queue (Felton 2). If this situation happens and the buffer gets full packets have to be dropped (Felton 2). This is usually done based on some sort of FIFO rule to be equally fair to everyone involved in the process (Felton 3). The end user however is unaware that all of this is going on and to them a dropped packet just appears to slow down the transmission of whatever was being sent at the time (Felton 3). Dropping packets is a normal part of the operation of routers and is a mechanism that was built into the internet to regulate speed (Felton 7). When communication happens on the internet one computer sends packets to another and also send acknowledgements back and forth to let the other computer know that the data was received (Felton 7). When routers begin to drop packets the communicating computers eventually realize that data is being lost and their software is automatically programmed to slow down the transmission of packets until an optimal rate with little or no loss is reached (Felton 7).

Broadband internet providers could and have had their routers scan packets and drop those that don't have priority based on whatever arbitrary reason they decide whether the queue is full or not (Felton 3, Wu 143). In addition, when there was a wait for packets to be processed by the router the packets waiting to be sent could be reordered by the router in such a way that packets with some sort of arbitrary priority are sent out first as opposed to the first come first serve principals that internet routers originally worked on (Felton 4). The purpose of doing such a thing would be to create a form of artificial slowness for a particular website or application that wasn't paying them a fee and give whatever service they chose faster service. This sort of discrimination in routers treatment of packets would have little effect on most applications (Felton 4). Most online activity like web browsing transmits packets in such a way that small delays in routing such as this will have little to no effect on the performance of this service (Felton 4). Other services such as VoIP and online gaming might take an immense performance hit from such preferential packet treatment (Felton 4). Both of these

services require a constant stream of packets to be traveling between two points for the services to operate smoothly (Felton 4). Imposing delays such as the ones just mentioned would likely cause distortion in VoIP phone conversations and lag in online gaming (Felton 4). This creates an interesting situation because most broadband providers also offer some sort of traditional phone service giving them plenty of motivation to impose such discrimination at their routers to make VoIP services less attractive to its customers so they will remain users of their traditional phone service (Felton 4).

The incentive for broadband providers to discriminate has presented itself and in March of 2005 a broadband company did just that (Cerf 5). In Cerf's address to congress he said, "...the FCC found that the Madison River Telephone Company was blocking ports used by its DSL customers to access competing VoIP services. Similar examples are emerging internationally as well. More revealingly, in recent months senior executives of major U.S. carriers (AT&T) have indicated publicly that they intend to force competing services and content providers to pay to be seen online. Together, these examples show that carrier discrimination is not a hypothetical concern." (Cerf 5).

In addition to trying to stop VoIP services many broadband providers already restrict their customers from using VPN connections through their standard home internet service (Wu 143). In order to use VPN technology you have to upgrade to some sort of higher priced package, usually some sort of "business" level plan (Wu 143). There is no extra hardware or services the customer would be paying extra for in order to use VPN technology, they would just be giving the provider extra money to unblock the service which they are blocking (Wu 143). In Felton's paper on the topic he suggests that VPN connections could be used to get around the discrimination broadband providers were imposing by encrypting the packets and using a gateway (7). It can then be suspected that broadband providers are blocking VPN connections to standard customers so that they still have the ability to leverage some sort of discrimination against the customer.

The fear is that not only will broadband providers use their position to restrict certain services, but in doing so will unintentionally restrict the development of new technologies that have yet to be conceived (Wu 145). Wu argues that it was the original openness of the internet that allowed it to develop and thrive with innovation to become what it is today (145). By placing these restrictions on specific services Wu worries that broadband providers are unknowingly hampering the development of future technologies on the internet. According to Wu the future of the internet as we know it may rest on the platform remaining neutral (146).

"A communications network like the Internet can be seen as a platform for a competition among application developers. Email, the web, and streaming applications are in a battle for the attention and interest of end-users. It is therefore important that the platform be neutral to ensure the competition remains meritocratic." (Wu 146)

In terms of traffic on the internet there is no rich man and there is no poor man, everyone's data is treated with equal respect by routers all around the country and world. Broadband internet service providers are trying to change that by defying the principals of network neutrality. These providers

have already shown a desire to try and place these sorts of restrictions inside their network to the detriment of network neutrality (Cerf 5, Felton 10, Wu 143). Without some sort of regulation to enforce network neutrality broadband providers will not only be able to monopolize what can be seen by the average user on the internet, but could also degrade the spirit of innovation that is at the heart of the internet.

## Bibliography

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